NOCoE
National Operations Center of Excellence

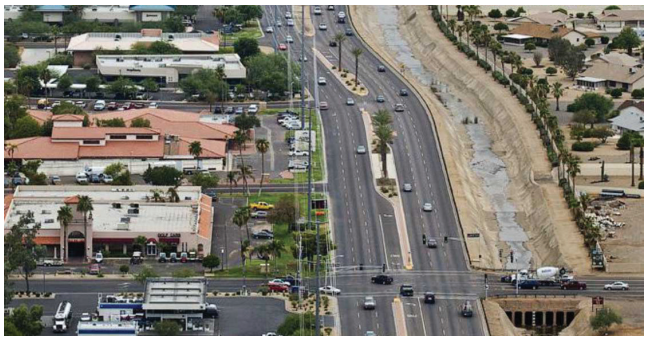
CASE STUDY

BELL ROAD ADAPTIVE SIGNAL CONTROL TECHNOLOGY PILOT DEPLOYMENT PROGRAM

By: Maricopa County Department of Transportation

IN THIS CASE STUDY YOU WILL LEARN:

1. How cities, Maricopa County and state governments came together to manage a congested corridor.
2. Processes for unifying separately owned signal systems into one adaptive signal control system.
3. How centralizing data limits the need for multiple r edundant servers and licenses throughout the region, resulting in cost savings.



BACKGROUND

The Phoenix Metropolitan Area is a geographically sprawling urban area near the center of Arizona. Bell Road is the most heavily traveled arterial corridor in the Phoenix metropolitan area, and traffic signals along Bell Road are operated by seven separate agencies making progression across the corridor challenging. The cities of Surprise, Peoria, Glendale, Phoenix and Scottsdale, along with the Maricopa County Department of Transportation (MCDOT) and the Arizona Department of Transportation (ADOT), have been working together as the Bell Road Coordination Committee. This committee has been working, through the AZTech Regional Partnership, for several years with the goal of improving mobility and safety while reducing congestion and travel time seamlessly across jurisdictional boundaries.

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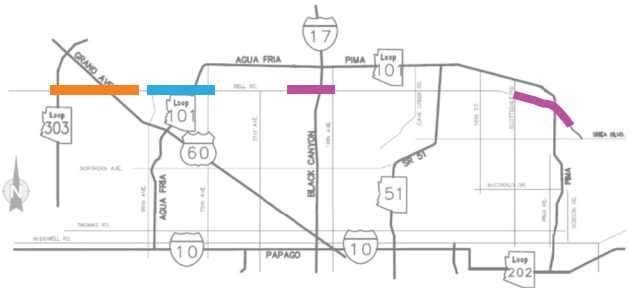
Agencies have partnered to improve signal timing plans across jurisdictional boundaries for many years. The partners found that timing plans needed frequent adjustments due to seasonal traffic volume fluctuations, continued growth in the north Phoenix Valley, and recurring demands due to special events. Additionally, coordinated timing plans were not able to account for differences in the controller clocks. Conversations began about the option of implementing Adaptive Signal Control Technology (ASCT) on Bell Road more than 10 years ago. The Bell Road Coordination Committee developed a unique approach to test different ASCT systems and strategies, and an ASCT system was implemented on this regionally-significant, multi-jurisdictional corridor as a better alternative solution to constructing costly lanes on an already extra-wide cross-section.

TSMO PLANNING, STRATEGIES, AND DEPLOYMENT

A systems engineering process was initiated in 2012 to determine if ASCT was the appropriate solution. The Bell Road corridor was broken down into four project areas, and each project area had different operating needs and priorities. A Concept of Operations and an overall Design Concept Report was completed in 2014 by Lee Engineering. Each project area procured the ASCT software through a request for proposal process, and procured detection and ARID travel time readers through a separate low-cost bid procurement. ASCT was initiated for each project area between February 2018 and April 2019.

Project Area 1 – City of Surprise Characteristics: 21 signals, including interchanges with State Route 303 Loop and US 60: The priority was to keep special event traffic at the Surprise Ballpark operating smoothly in addition to typical daily traffic flow. Kadence



from Kimley-Horn was the selected system and it is a centralized, software-only system. The system solves for new cycle lengths, splits, offsets, and sequencing every several cycles after an initial baseline timing plan is set. The new timing plans are saved and over time, the system can determine a new baseline timing plan based on historical data. A transition period is still required when a signal timing change is made.

Project Area 2 – Cities of Peoria and Glendale, MCDOT and ADOT Characteristics: 3 signals operated by MCDOT, 4 Peoria traffic signals, 1 ADOT signal and 5 Glendale signals. Keeping a distributed system for maintaining cross-jurisdictional progression was a key priority, as was the traffic surrounding the Peoria Sports Complex and the holiday shopping traffic surrounding the Arrowhead Mall. In|Sync by Rhythm Engineering was selected. This solution included a detection system and has the most adaptive signal features of the systems chosen. There is no transition period between cycles, and changes from one cycle to the next are as aggressive as the user defines.

Project Area 3 – City of Scottsdale and Project Area 4 – City of Phoenix and ADOT: Project Area 3 contains 10 signals, all operated by the City of Scottsdale. Priorities in Project Area 3 are traffic volumes during typical weekday peak times and the heavy vehicular and pedestrian traffic during special events. Project Area 4 has 6 signals operated by the City of Phoenix and 1 signal operated by ADOT. The Project Area 4 priority was to improve progression of traffic across the I-17 interchange without negatively impacting the freeway ramps. The TransCore ACDSS was selected for both areas. This is a centralized, software-only system. This system requires input signal timing plans and can use immediate historical data to determine the most appropriate timing plan. Timing plans are re-evaluated every several cycles (user defined). ASCT system providers worked with the vehicle detection vendors to configure detection system requirements. The systems were evaluated using Automated Traffic Signal Performance Measures at available locations and with third party data sources (INRIX). Although performance metrics are available through each of the ASCT systems, it was determined that an independent tool would provide better analytics.

COMMUNICATIONS PLANNING AND EXECUTION

The work leading up to the 2018 implementation began several years prior, including establishing the Bell Road Coordination Committee, TSMO planning for corridor operations, and a robust systems engineering process to define needs, identify challenges, and prepare concepts for ASCT implementation on distinct segments. Partner agencies worked together to define specific needs, identify constraints, and define requirements which were ultimately used to procure separate systems for different segments of the corridor. Public outreach was a crucial component to the success of this project. Business owners adjacent to the project areas were informed throughout the project timeframe. Through the AZTech Regional Partnership, many levels of management and staff were kept informed about the progress of the project. Many media outlets, including radio and TV channels, reported on the project throughout the various stages of the project. The Bell Road Coordination Committee meets regularly to collaborate on operations, plan for seasonal traffic variations and for special events. Results are shared with the broader AZTech partnership and the MAG ITS Committee. Lessons learned from Bell Road are shared with other agencies considering ASCT.

OUTCOMES, LEARNINGS, AND PUBLIC BENEFIT

The pilots showed improvement in costs, delays and travel times across the corridor, and these results are summarized below, with lessons learned following the table.

Project Area	Cost Savings Weekday	Cost Savings Weekend	Travel Time Savings Weekday	Travel Time Savings Weekend
1	$9500	$9500	20%	43%
2	$25,900	$1600	51%	7%
3	$(5,900)	$2700	-43%	31%
4	$(320)	$360	16%	2%

- Preliminary Engineering is Key – The SE process supported the complex implementation of the system. The Concept of Operations documents provided a blue print for the procurement, implementation and acceptance testing of each of the systems.
- Software and Detection Should Go Together – The process for Bell Road was to submit an RFP for an ASCT software vendor, then confer with that vendor to determine the best detection configuration and solicit a low-cost bid for installation of the detection.
- Budget for Communication Upgrades – Additional work was needed to improve communications infrastructure that was not initially anticipated.
- Non-Motorized Traffic – Special events generate high pedestrian volumes. The vendor and city found it challenging to meet the needs of accommodating high pedestrian volumes while maintaining a high level of corridor progression.
- Seek Training in Advance – Knowledge of detection systems and configurations prior to deployment is critical.
- Regional Collaboration and Strong Leadership – Relationships and trust among the team members were well established in advance of this project and helped to lead the project through successful implementations and evaluations.

FURTHER INFORMATION

Project Website: https://www.maricopa.gov/4553/Adaptive-Signals
NOCoE Knowledge Center: https://transportationops.org/knowledge-center